



Honduras: Changing Land Use Today for a More Resilient Tomorrow

DID YOU KNOW THAT IN SOME PLACES THE WATER YOU GET FROM YOUR TAP IS AFFECTED BY WHAT HAPPENS IN THE FOREST?

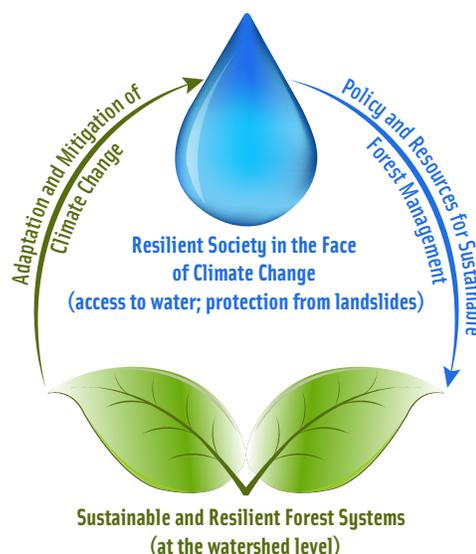
Climate change and demographic pressures are leading policy makers to rediscover the connection between healthy forests and trees, and the welfare of other sectors such as agriculture, water and energy. Honduras provides a case study for how sustainable forest management and improved land use practices could enhance resilience to climate change by helping protect water resources.

In Honduras, climate change is expected to increase temperatures and decrease rainfall through 2050, exacerbating a lack of drinking water that has already forced the government to ration water in the capital of Tegucigalpa so that some of the city's one million residents receive water only once a week.

Natural disasters, agriculture, and urban sprawl have depleted forests and left watersheds vulnerable to extreme weather events. Hurricanes and tropical storms have repeatedly whipped through the Central American nation, damaging reservoirs that are the source of water for people and crops. The situation became so dire that from 1992 to 2011, Honduras ranked third on a global climate risk index compiled by Germanwatch, an environmental think tank.

Adaptation measures based on healthy forests and trees in landscapes could help reverse that trend. Forests are critical to preserving the water supply by preventing soil erosion, slowing flooding, and storing carbon, which helps to slow the rate that temperatures increase due to climate change. Forests may also help farmers adjust to the drier growing conditions and erratic rainfall patterns that scientists predict will be caused by climate change by providing alternative sources of income during drought or crop failure.

FORESTS ARE A KEY COMPONENT OF ADAPTATION-BASED MITIGATION



AT A GLANCE

- Climate change will lead to higher temperatures, less rainfall and water runoff, and drier areas around Tegucigalpa, the capital of Honduras, which will impact the availability of drinking water systems reliant on surface water.
- A study found that good land management practices could offset the negative impacts of climate change on soil erosion. Conversely, inadequate land use could erase the positive benefits predicted in some scenarios, and result in as much as a 155 percent increase in soil erosion.

BACKGROUND

While several watersheds provide Tegucigalpa with water, the city relies on just two reservoirs—Concepcion and Los Laureles—to supply drinking water to more than one million inhabitants. Of the two, only the Los Laureles reservoir is located in the Guacerique watershed, an area that the Government of Honduras identified as one of the most vulnerable to climate change following Hurricane Mitch in 1998. Since Mitch, the reservoir has lost an estimated 15 percent of its storage capacity due to increased sedimentation. The watershed is important because it supplies water to 25 percent of the water supply connections in Tegucigalpa.

In addition to the decreased reservoir capacity, urban development and several tropical storms that followed Hurricane Mitch have resulted in rapid deforestation of the watershed, leading to greater soil erosion, more runoff, and less water captured by the reservoir. Meanwhile, farmers have steadily moved into the area, despite laws designating the watershed as a protected public forest and a smaller part of it as a biological reserve. From 1993 to 2008, an estimated 15 percent of forests in the watershed were converted to agricultural use.

GOVERNMENT RESPONSE

To address the water shortage in Tegucigalpa, the national water utility has drawn up plans over the years to construct new reservoirs or improve existing ones, build an inflatable barrier on the Los Laureles reservoir, and lay a pipeline that would run from Los Laureles to a nearby water treatment plant, but financing has not been secured for any of these projects.

In 2011, the water utility switched gears and created a plan for ecosystem-based adaptation to

climate change designed to increase the amount of drinking water coming from the Guacerique watershed by preserving forests, among other environmental measures. Specifically, the government's \$4.2 million water management plan called for:

- Reforesting of 1,236 hectares (ha) around springs and creeks
- Creating 100 ha of fuel wood plantations
- Transitioning to agroforestry on 161 ha of steeply sloping agricultural land
- Concentrating forest fire control on reforested areas
- Reducing illegal timber extraction on 6,063 ha of forest reserves
- Concentrating pest control on 4,338 ha of existing pine forests
- Implementing soil conservation measures on 2,000 ha of agricultural fields

However the water utility has not been able to get adequate funding and community buy-in for the plan. One of the challenges is the ongoing decentralization of drinking water services from the water utility to municipal service providers. Another challenge related to an important knowledge gap: Until now, the potential benefits of this approach compared to a more conventional infrastructure approach were poorly understood.

THE STUDY

In 2011, the Program on Forests (PROFOR), the Center for International Forestry Research (CIFOR) and the Tropical Agricultural Research and Higher Education Center (CATIE) collaborated on a study that collected primary data and used 16 possible climate change scenarios and four land use scenarios over a 20- to 50-year time horizon, and downscaled these to understand the impact

of both climate change and land use management on the capacity of the Guacerique watershed and the Los Laureles reservoir to provide reliable, high quality drinking water to residents of Tegucigalpa. The study considered the potential environmental and economic impact of the government's plan to manage forests in the watershed.

MAIN FINDINGS

All 16 climate change models showed increasing temperatures to the years 2030 and 2080, and the majority of the models predicted a reduction in rainfall and a shortened rainy season, resulting in reduced runoff except during periods of extreme weather, when soil erosion and the deposits of sediment into the reservoir would increase.

However, the analysis found that good land-management plans, including reforestation, can act as a buffer to offset some of the negative impacts of climate change on soil erosion: even though soil erosion can increase by 5 percent under one scenario, erosion can be reduced by 32 percent with good land use management. By the same token, the study found that inadequate land use management can effectively erase the positive effects on the soil predicted by some climate change scenarios: In one scenario, the benefits of lower rainfall on soil erosion were lost to inappropriate land use, with the worst scenario resulting in an increase of soil erosion of 155 percent.

The economic analysis, conducted under two climate change scenarios, provided a strong case for the national water utility's ecosystem based adaptation plan: It estimated that Honduras could expect a net economic benefit of between \$28 million and \$76 million, depending on the severity of climate change on rainfall and soil erosion. The benefits were calculated by subtracting the

cost of the watershed plan from the benefits of its implementation (specifically benefits derived from decreased sedimentation in the reservoir, water inflow to the reservoir and decrease in water turbidity). The analysis relied on social discount rates of between 2.1 and 4.5. (It did not factor in extreme events, however, because of modeling challenges.)

RECOMMENDATIONS

HELP TO SECURE FUNDING FOR WATERSHED MANAGEMENT PLANS

The government needs to fund the \$4.2 million watershed management plan, but sources of money are scarce. The study provides the economic case for dedicating funds to ensure that legislation regarding water management can be fully implemented.

SUPPORT FARMERS' ADOPTION OF SOIL AND FOREST CONSERVATION PRACTICES

Farmers will likely have to adjust to drier growing conditions and erratic rainfall patterns. They will be best equipped to make this adjustment if they have access to technical assistance to improve farming methods in ways that preserve soil and trees and are more aware of the downstream benefits of such practices.

PROMOTE ENFORCEMENT OF LEGISLATION TO PRESERVE FOREST AND WATER RESOURCES

Honduras has passed laws to manage the Guacerique watershed, but lacks the capacity to implement and enforce the legislation. Limited financial and technical resources hamper the government's ability to stop illegal logging and other practices that undermine sound watershed management. For an ecosystem-based adaptation to climate

RECOMMENDATIONS (CONT.)

change to succeed, various government entities must work together to enforce existing laws. Communities should play an important role in enforcement.

MONITOR THE EFFECTS OF USING FORESTS AS AN ECOSYSTEM-BASED ADAPTATION TO CLIMATE CHANGE

Forests can slow the rate of soil erosion, but uncertainties surrounding climate change can make it difficult to predict the success of any watershed management plan. Land use priorities also may change over time. Therefore, monitoring the impact of the

watershed management plan on soil and other resources is critical to allow for adjustments to changing environmental and land use circumstances.

PUBLICIZE THE POTENTIAL OF FORESTS AS AN ECOSYSTEM-BASED ADAPTATION TO CLIMATE CHANGE THAT CAN PROVIDE OTHER BENEFITS

The Guacerique watershed provides fiber, food, pollination, nutrient cycling and other resources that contribute to the livelihoods of the local population. However, farmers continue to use chemical fertilizers and other farming methods that harm the soil. Publicizing the potential benefits of forests to farmers could increase their willingness to comply with conservation laws and the watershed management plan.

CONCLUSION

The world's temperatures are continuing to increase, forcing long-term strategies for adaptation to climate change. The availability of water is declining and the risk of disasters is increasing. Unsustainable logging and agricultural practices have led to deforestation, resulting in deadly floods and landslides. Forests can not only help mitigate climate change by storing carbon and slowing the rate of temperature increases. Sustainably managed forests and trees on farms can also help soften the blow of climate-induced changes by reducing soil erosion and regulating water flows at the scale of entire landscapes.



This case study is part of a larger report on *Using Forests to Enhance Resilience to Climate Change* funded by PROFOR and the Trust Fund for Environmentally and Socially Sustainable Development. PROFOR, CIFOR and CATIE collaborated on the Honduras case study, which was authored by Raffaele Vignola PhD, Amanda Proctor MA., Tim McDaniels PhD, Angela Diaz Briones MSc., Serge Rafanoharana Msc., Bruno Locatelli PhD, and Aaron J.M. Russell PhD.

Learn more at <http://www.profor.info/node/2032>